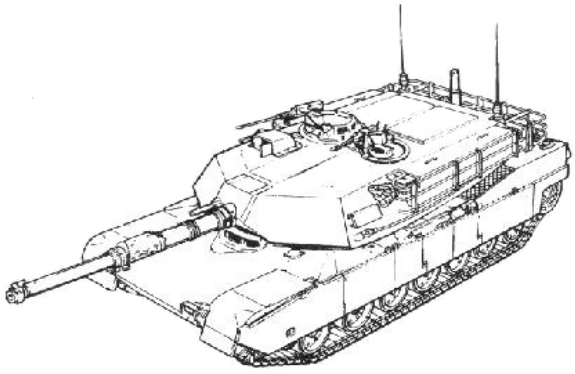
JOB PERFORMANCE AID HANDBOOK

TANK WEAPON GUNNERY SIMULATION SYSTEM (TWGSS)

FOR

TANK, COMBAT, FULL-TRACKED: 105-MM GUN, M1
TANK, COMBAT, FULL-TRACKED: 120-MM GUN, M1A1



LOCAL REPRODUCTION AUTHORIZED

This manual supersedes Job Performance Aid Handbook dated 15 May 1995.

HEADQUARTERS, DEPARTMENT OF THE ARMY

1 OCTOBER 1998

FOR INFORMATION ON FIRST AID, REFER TO FM 21-11.

WARNING

Vehicle master power switch, turret power switch, and turret networks box (TNB) utility power switch must be in OFF position before connecting or disconnecting cables and installing or removing system components. Failure to follow this warning may cause turret or main gun movement, resulting in injury or death to personnel.

WARNING

Ensure all cables and components are properly installed and secured. Improper installation can cause damage to equipment or injury to personnel.

WARNING

ALWAYS refer to the Improved Tank Gunfire Simulator (ITGS) (Hoffman Device) operator's manual (see TD 17-6929-702) prior to installing, removing, loading, or firing simulator.

WARNING

Tank MUST be equipped with LRF ELF during ALL training exercises. Failure to follow this warning may result in injury or blindness to personnel.

WARNING

Gun must be locked to turret roof and turret traverse lock must be engaged before installing or removing components/cables under main gun. Failure to follow this warning may result in injury or death to personnel.

WARNING

Transceiver unit has an eye-safety classification of 3A. During operation, DO NOT view the transceiver unit with an unaided eye for an extended period of time.

WARNING

The commander must ensure that the loader and other personnel remain a safe distance away from the main gun when not actively participating in TWGSS alignment procedures. Failure to follow this warning may result in injury or death to personnel.

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CHAPTER 1
INTRODUCTION

1-1. GENERAL.

a. This Job Performance Aid Handbook is intended for use by trained Tank Weapon Gunnery Simulation System (TWGSS) personnel. The handbook serves as a handy memory jogger to assist trained operators with required procedures.

b. Refer to TM 9-6920-709-12&P-1-1 for more information on TWGSS and refer to TM 9-6920-711-12&P-1 for more information on CGUN/TDRS.

1-2. EQUIPMENT DESCRIPTION.

a. **Purpose of TWGSS.** The TWGSS is a tank-mounted training device that aids the crew in gaining and improving proficiency in gunnery skills without the expenditure of live ammunition. Gunnery and tactical training can be conducted anywhere that eye-safe laser firing is permitted. TWGSS provides the crew with visual and sound effects which accurately simulate real firing conditions.

b. **Functional Configuration.** The TWGSS simulates the firing of the tank's main gun, the firing of the coaxially-mounted machine gun, and the effects of a target vehicle being hit. The TWGSS consists of three subsystems: firing system, target system, and Training Data Retrieval System (TDRS).

(1) **Firing System.** TWGSS simulates the firing ballistic characteristics of ammunition and the visual and sound effects of firing.

(2) **Target System.** The target system receives firing information from an attacking weapon, equipped with a laser training device, and notifies the crew of the effects of the attack. The attack could come from another TWGSS-equipped tank, a Precision Gunnery System (PGS)-equipped vehicle, or a Multiple Integrated Laser Engagement System (MILES)-equipped vehicle. An instructor using the control gun (CGUN) can also communicate with the TWGSS target system.

(3) **TDRS.** The TDRS is used to evaluate the effectiveness of the firing engagements whether in a tank weapon gunnery exercise or a tactical training environment. The TDRS provides real time analysis for each round fired and engagement under taken. For more information on TDRS, refer to TM 9-6920-711-12&P-1.

c. **Features and Capabilities.**

(1) Simulates tank firing and ammunition effect on targets.

(2) Provides full fire control interface to enable the tank crew to train using normal engagement techniques.

(3) Provides training capabilities utilizing Class 3A (conditionally eye safe) eye-safe laser.

(4) Interoperable and compatible with PGS, MILES, Laser Target Interface Device (LTID), Thru-Sight Video (TSV) System, and Improved Tank Gunfire Simulator (ITGS) (Hoffman Device).

NOTE

For detailed information on scaled gunnery or tracking training see TM 9-6920-709-12&P-1-1.

(5) Provides panel gunnery training, target tracking training, 1/10th and 1/2 scale target capability, and force-on-force training in a realistic environment with immediate feedback.

1-2. EQUIPMENT DESCRIPTION (Con't).

(6) Simulates the visual effects of the main gun and coaxially-mounted machine gun. These simulations include tracer, tracer burst on target, burst on ground, and obscuration images.

(7) Provides firing sound effects over tank intercom. These sound effects include:

(a) Main gunfire signature

(b) Coax gunfire signature

(c) Hit indication

(d) Ammunition loading

(e) System error indication

(8) Provides and stores continuously updated vehicular position, firing events, and time data information that can be utilized for the conduct of the AAR.

CHAPTER 2
OPERATING INSTRUCTIONS FOR TWGSS

Section I. PREPARATION FOR OPERATION

2-1. PRELIMINARY INSPECTION INSTRUCTIONS.

a. Perform *Before* operation Operator/Crew Preventive Maintenance Checks and Services (PMCS) (see TM 9-6920-709-12&P-1-1).

b. Inspect all tank connectors for dirt and damage prior to installing system components.

2-2. VEHICLE PREPARATION INSTRUCTIONS.

WARNING

Tank MUST be equipped with laser rangefinder (LRF) eye-safe laser filter (ELF) during ALL training exercises. Failure to follow this warning may result in injury or blindness to personnel.

a. Ensure LRF ELF is installed (see TM 9-2350-255-10-1 or TM 9-2350-264-10-1).

NOTE

Improper boresighting of vehicle will result in poor training results.

b. Perform prepare-to-fire checks and boresighting procedures (see TM 9-2350-255-10-2 or TM 9-2350-264-10-2).

2-2. VEHICLE PREPARATION INSTRUCTIONS (Con't).

c. Using manual turret and gun controls, position main gun over right #2 road wheel.

WARNING

Gun must be locked to turret roof and turret traverse lock must be engaged before installing or removing components/cable assemblies under main gun. Failure to follow this warning may result in injury or death to personnel.

d. Secure main gun to turret roof with elevation lock and position turret traverse lock in LOCKED position.

e. Remove main gun muzzle plug and inspect and clean interior of muzzle.

f. Inspect and clean gunner's auxiliary sight (GAS) optical port for dirt and debris.

g. Remove loader's periscope from loader's hatch and stow periscope in left turret storage box.

h. Remove computer electronics unit (CEU) protective guard from turret floor, using 9/16 in. socket.

i. Input the following computer correction factors using gunner's computer control panel (CCP):

2-2. VEHICLE PREPARATION INSTRUCTIONS (Con't).

NOTE

Enter the following data with MANUAL INPUTS.

Ammunition	Sub-designation	Azimuth	Elevation
M1 HEAT M456A2	0	0.00	-0.60 Up
M1 SABOT M900	0	-0.2 Left	-0.40 Up
M1A1 HEAT M830	0	-0.25 Left	+0.37 Down
M1A1 MPAT M830A1	0	+0.05 Right	-0.6 Up
M1A1 SABOT M829A1	5	0.00	-0.45 Up

j. Input the following ballistic simulation data using gunner's CCP:

NOTE

Leave CANT, LEAD, and RANGE buttons in normal operation.

(1) Set crosswind sensor value to 0 mph and cancel out automatic input (leave button lit when CCP is switched OFF).

(2) Set ammunition temperature to 69.8° F.

(3) Set air temperature to 59° F.

(4) Set barometric pressure to 29.92 in. of mercury.

(5) Set coax boresight azimuth and elevation values to same as main gun boresight values.

(6) Set coax zero to 0.0 0.0.

2-2. VEHICLE PREPARATION INSTRUCTIONS (Con't).

NOTE

Perform step (7) for M1 only.

(7) Set gun tube wear to 0.0 in.

WARNING

Vehicle master power switch, turret power switch, and turret networks box (TNB) utility power switch must be in OFF position before installing system components.

k. Place vehicle master power switch and turret power switch in OFF position.

l. Place TNB utility power switch in OFF position.

m. Install Improved Tank Gunfire Simulator (ITGS) (Hoffman Device) (see TD 17-6920-702).

n. Install Thru-Sight Video (TSV) System (see TD 9-6920-708-10, Vol. 2 of 2).

2-3. INSTALLATION OF EXTERIOR COMPONENTS.

NOTE

Adjustments to the tank's loading plan may be required to ensure that TWGSS components are properly installed.

a. **TU Installation.**

CAUTION

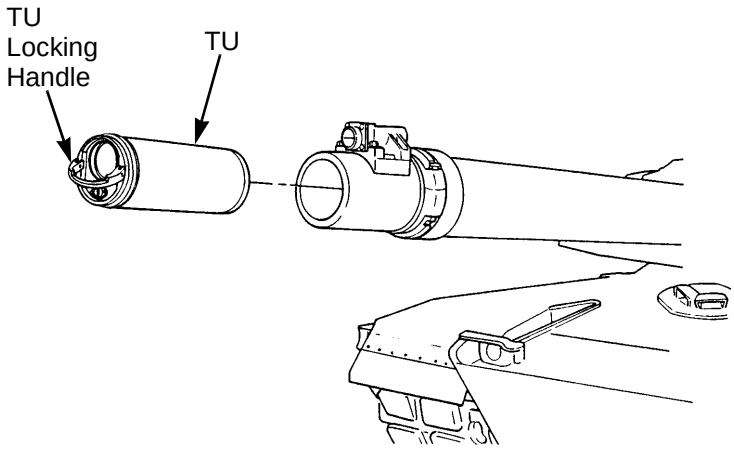
Ensure that TU is properly LOCKED into 120 mm adapter by checking that locking handle is in raised position. Failure to perform this check may result in the TU falling out of adapter.

(1) Lift locking handle to unlocked position.

(2) Position TU approximately 4-6 in. (10.16-15.24 cm) inside main gun.

(3) Using locking handle, rotate TU until laser lens is at 12 o'clock position.

(4) Push locking handle up to locked position.

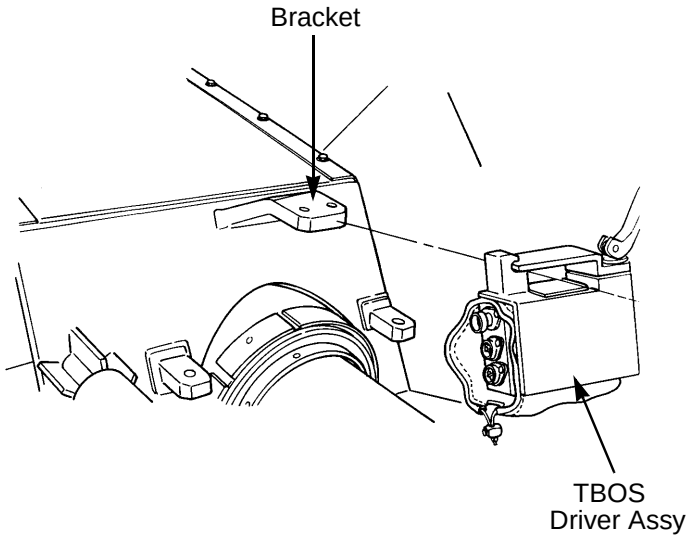


2-3. INSTALLATION OF EXTERIOR COMPONENTS (Con't).

b. **TBOS Driver Assembly Installation.**

(1) Position TBOS driver assembly on bracket.

(2) Pushing locking handle down to locked position.



c. **TBOS GAS Installation.**

NOTE

TBOS GAS assembly is properly seated when mounting bracket is flush with main gun mantel lower armor plate.

(1) Position TBOS GAS assembly in GAS optical port.

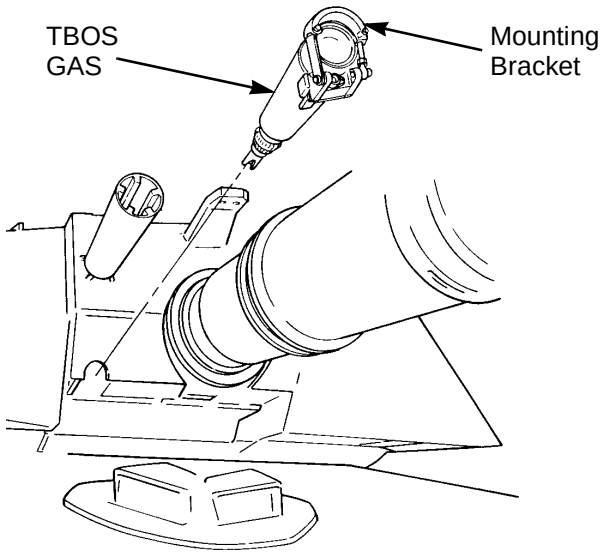
(2) Engage mounting bracket with roof of GAS optical port.

CAUTION

DO NOT overtighten locking nut. Overtightening will cause damage to TBOS GAS unit and reticle dot will not be properly aligned within GAS field of view.

(3) Tighten locking nut using 13 mm open end wrench from tank BII.

2-3. INSTALLATION OF EXTERIOR COMPONENTS (Con't).



2-3. INSTALLATION OF EXTERIOR COMPONENTS (Con't).

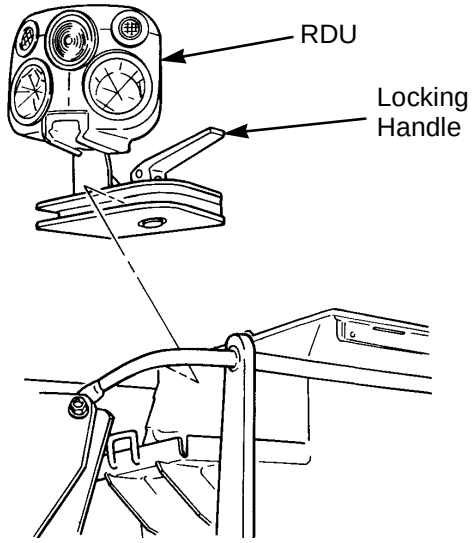
d. **RDU Assembly Installation (Right- and Left-Front).**

NOTE

- **Right- and left-front RDU assemblies are installed the same way. Left-front RDU assembly is illustrated. Perform this procedure for both retro detector assemblies.**
- **Go to subparagraph e. for vehicles equipped with M257 grenade launchers**

(1) Lift locking handle and position RDU assembly on upper bustle rack railing forward of sponson box.

(2) Push locking handle down to locked position.



2-3. INSTALLATION OF EXTERIOR COMPONENTS (Con't).

e. **RDU Assembly Installation (Right- and Left-Front) (M257 Grenade Launcher-Equipped Vehicles).**

NOTE

RDU adapters are stored with their respective RDU assembly in TWGSS storage case.

(1) Unlock locking handle and install RDU assembly on upper bustle railing forward of sponson box.

(2) Rotate locking handle to LOCKED position.

(3) Pull up on mounting bracket retaining strap and release crosspin from RDU.

(4) Remove RDU from mounting bracket.

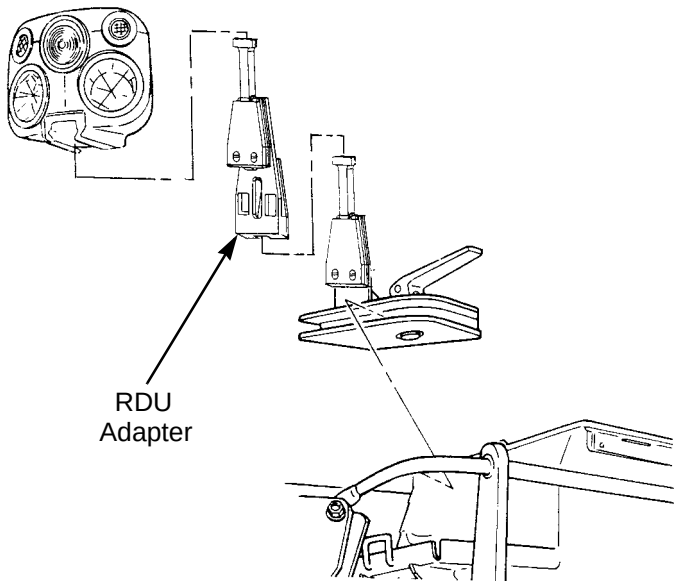
(5) Position adapter on mounting bracket.

(6) Pull up on mounting bracket retaining strap and secure crosspin on adapter.

(7) Position RDU on adapter.

(8) Pull up on adapter retaining strap and secure crosspin to RDU.

2-3. INSTALLATION OF EXTERIOR COMPONENTS (Con't).



2-3. INSTALLATION OF EXTERIOR COMPONENTS (Con't).

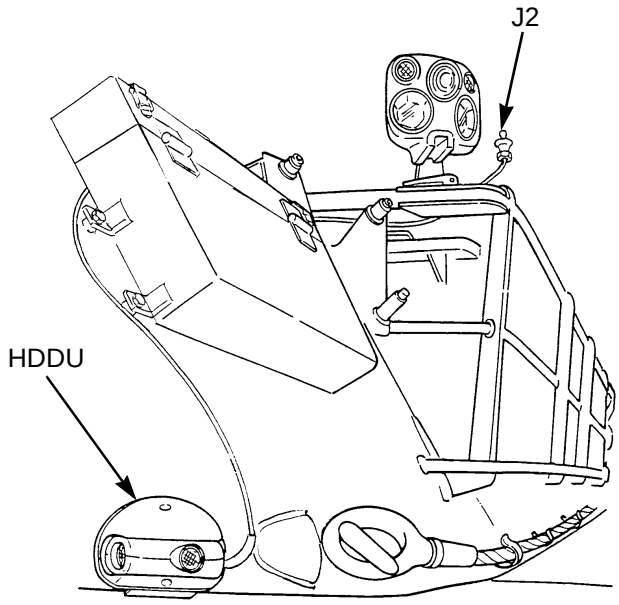
f. **HDDU Installation (Right- and Left-Front).**

NOTE

Right- and left-front HDDUs are installed the same way. Left-front HDDU is illustrated. Perform this procedure for both HDDUs.

(1) Position HDDU on lower edge of turret next to brush deflector.

(2) Route HDDU cable to RDU and connect cable connector J2. Secure HDDU cable with velcro straps.

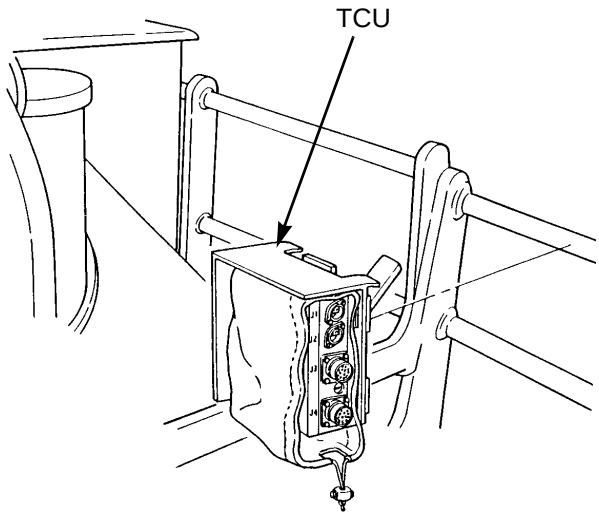


2-3. INSTALLATION OF EXTERIOR COMPONENTS (Con't).

g. **TCU Assembly Installation.**

(1) Position TCU assembly on inside of right-rear bustle rack railing with electrical connectors facing rear of tank.

(2) Push locking handle down to locked position.



2-3. INSTALLATION OF EXTERIOR COMPONENTS (Con't).

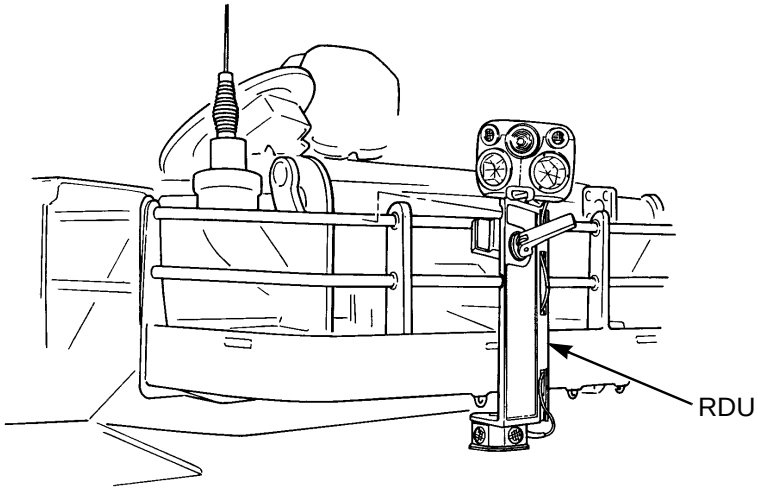
h. **RDU Assembly Installation (Right- and Left-Rear).**

NOTE

Right- and left-rear RDU assemblies are installed the same way. Left-rear RDU assembly is illustrated.

(1) Position RDU assembly on turret bustle rack on outside of outermost vertical bar.

(2) Push locking handle down to locked position.

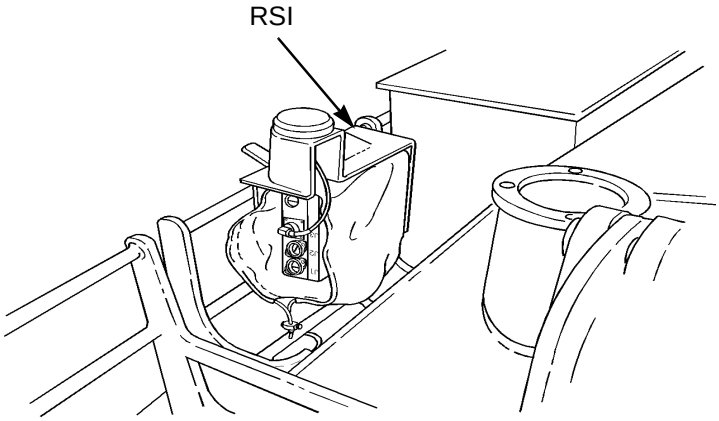


2-3. INSTALLATION OF EXTERIOR COMPONENTS (Con't).

i. **RSI Assembly Installation.**

(1) Position RSI assembly on inside of left-rear bustle rack railing flush with sponson box, with electrical connectors facing rear of tank.

(2) Push locking handle down to locked position.



2-4. INSTALLATION OF EXTERIOR CABLES.

a. **W1 Cable Installation.**

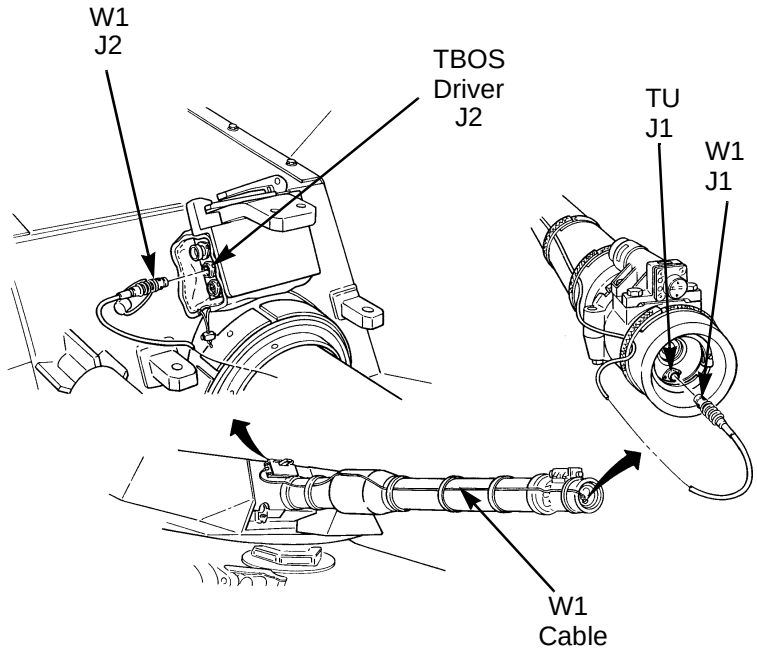
(1) Connect W1 connector J1 to TU connector J1.

CAUTION

Route and secure W1 cable rearward on upper right side (1 o'clock) of main gun. Damage to cable will result from engine exhaust heat when main gun is over back deck.

(2) Route W1 cable along upper right side of main gun and secure with evenly spaced velcro straps.

(3) Connect W1 connector J2 to TBOS driver unit connector J2.



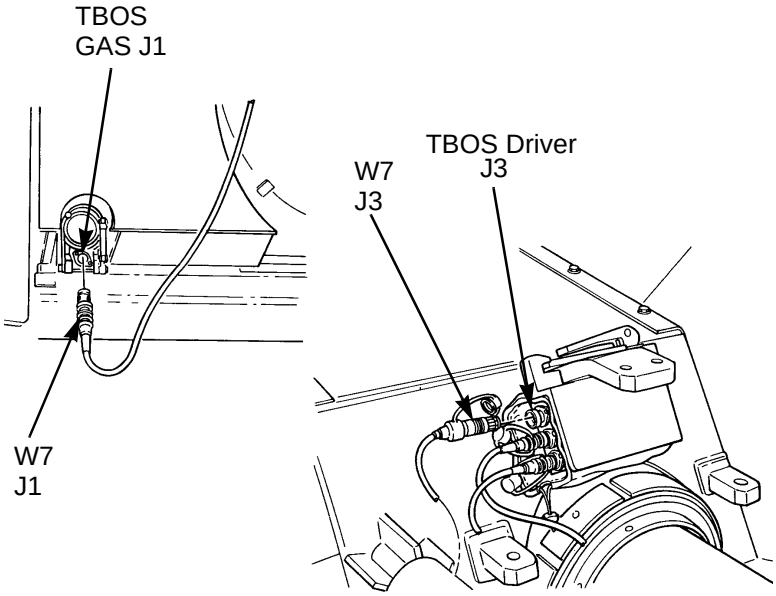
2-4. INSTALLATION OF EXTERIOR CABLES (Con't).

b. **W7 Cable Installation.**

(1) Connect W7 connector J1 to TBOS GAS assembly connector J1.

(2) Route W7 cable on turret along right side of main gun and secure to turret with velcro straps.

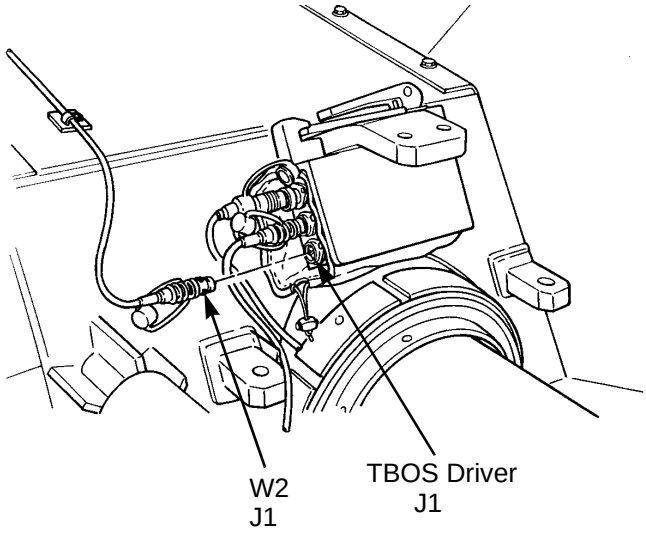
(3) Connect W7 connector J3 to TBOS driver unit connector J3.



2-4. INSTALLATION OF EXTERIOR CABLES (Con't).

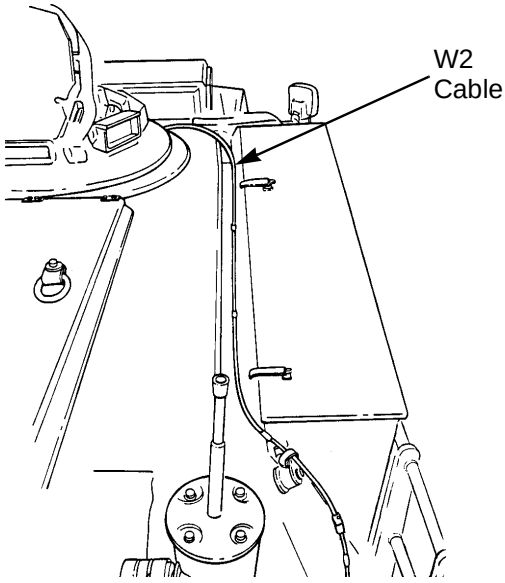
c. **W2 Cable Installation.**

(1) Connect W2 connector J1 to TBOS driver unit connector J1.

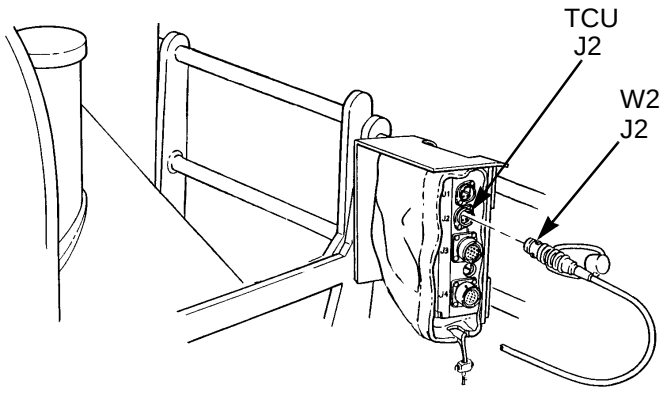


2-4. INSTALLATION OF EXTERIOR CABLES (Con't).

(2) Route W2 cable over turret roof behind gunner's primary sight (GPS) to right of sponson box. Secure with magnetic attachment.



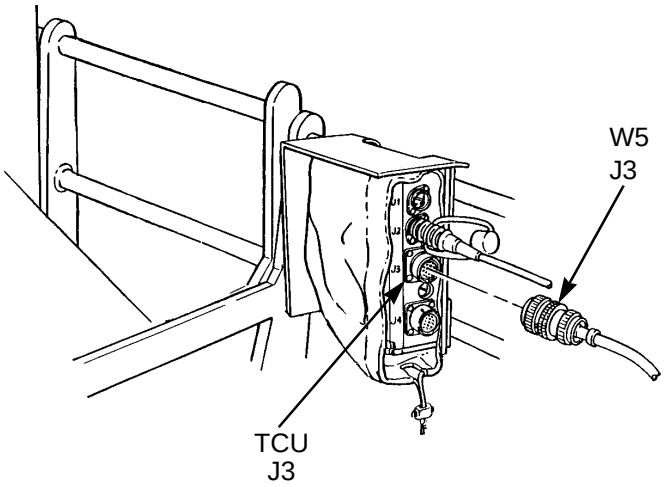
(3) Connect W2 connector J2 to TCU connector J2.



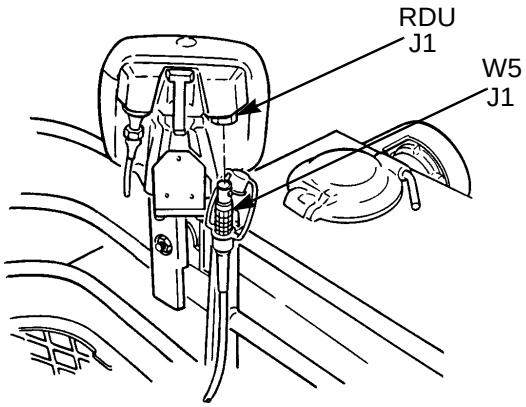
2-4. INSTALLATION OF EXTERIOR CABLES (Con't).

d. **W5 Cable Installation.**

(1) Connect W5 connector J3 to TCU connector J3.

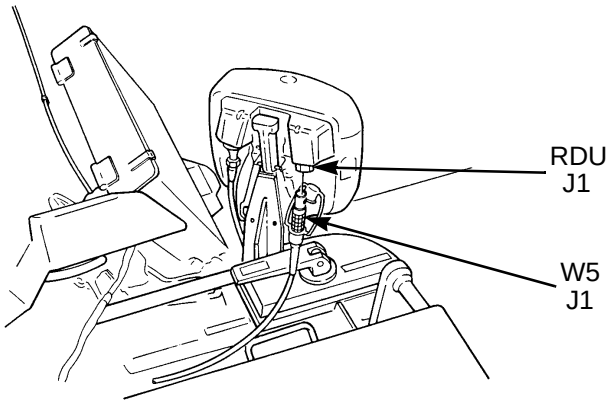


(2) Route W5 cable short lead to right-rear RDU assembly. Connect W5 connector J1 to right-rear RDU unit connector J1.

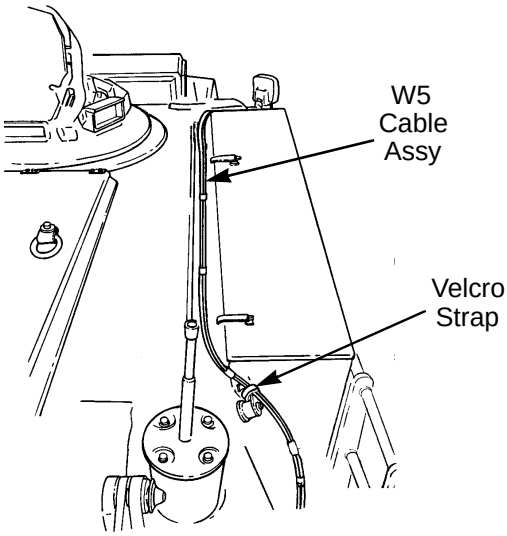


2-4. INSTALLATION OF EXTERIOR CABLES (Con't).

(3) Route W5 cable long lead along sponson box to right-front RDU assembly. Connect W5 connector J1 to right-front RDU connector J1.

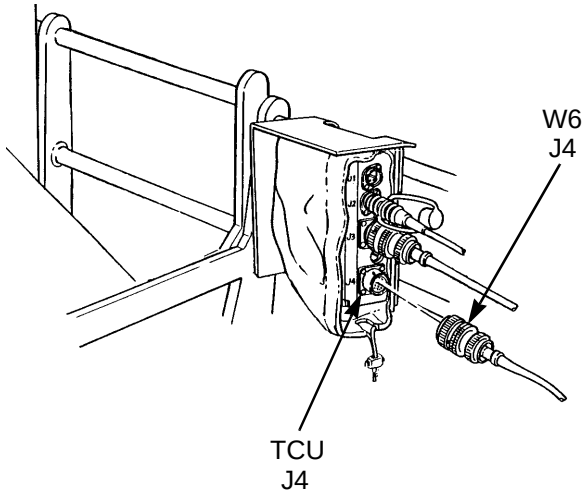


(4) Secure W5 cable along right side of turret roof with velcro straps.

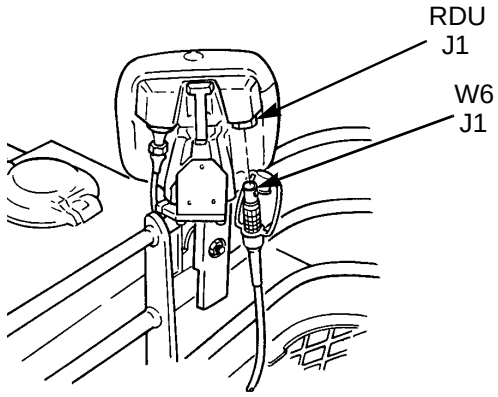


e. **W6 Cable Installation.**

(1) Connect W6 connector J4 to TCU connector J4.

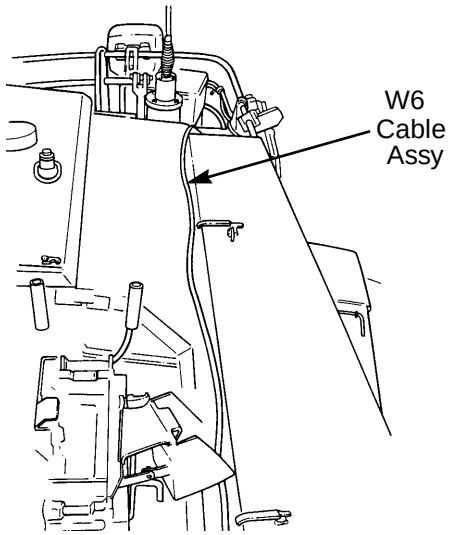


(2) Route W6 cable short lead along inside of turret bustle rack railing to left-rear RDU assembly. Connect W6 connector J1 to left-rear RDU connector J1.

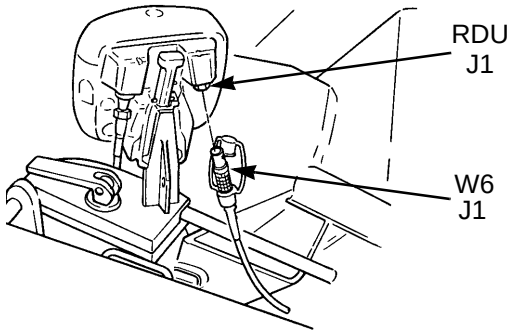


2-4. INSTALLATION OF EXTERIOR CABLES (Con't).

(3) Route W6 cable long lead along inside of turret bustle rack railing and left sponson box rear railing to left-front RDU assembly.



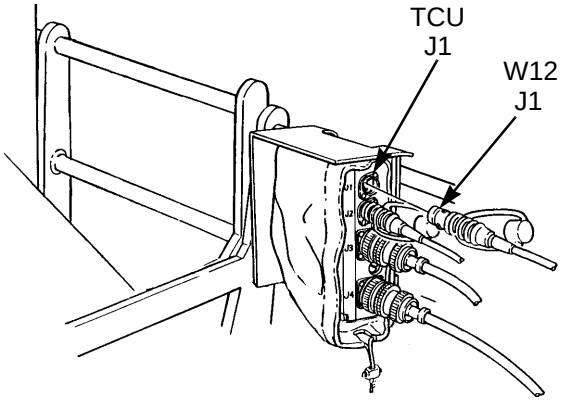
(4) Connect W6 connector J1 to left-front RDU connector J1.



2-4. INSTALLATION OF EXTERIOR CABLES (Con't).

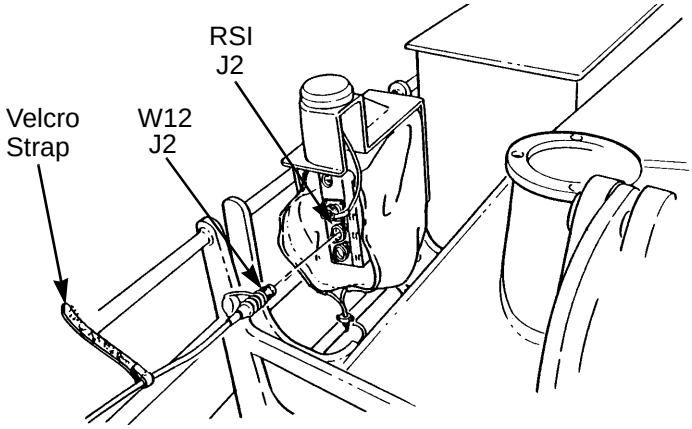
f. **W12 Cable Installation.**

(1) Connect W12 connector J1 to TCU connector J1.



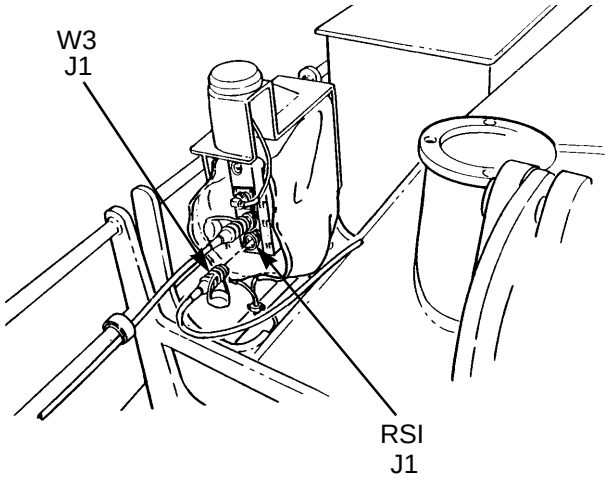
(2) Route W12 cable along inside of turret bustle rack railing, and connect W12 connector J2 to RSI unit connector J2.

(3) Secure W12 cable along bustle rack railing with velcro straps.



g. **W3 Cable Installation.**

(1) Connect W3 connector J1 to RSI unit connector J1.



NOTE

Allow slack when routing W3 cable through loader's hatch grommet. This will enable loader's hatch to open and close without straining W3 cable.

(2) Route W3 cable through loader's hatch grommet.

(3) Install loader's hatch grommet on loader's hatch with three retaining screws.

NOTE

Rotate periscope mount facing rearward. Attach cable magnets as close to hatch hinges as possible.

(4) Attach one cable magnet on outside of loader's hatch as close to hatch hinge as possible. Attach one cable magnet on inside of loader's hatch as close to hatch hinge as possible.

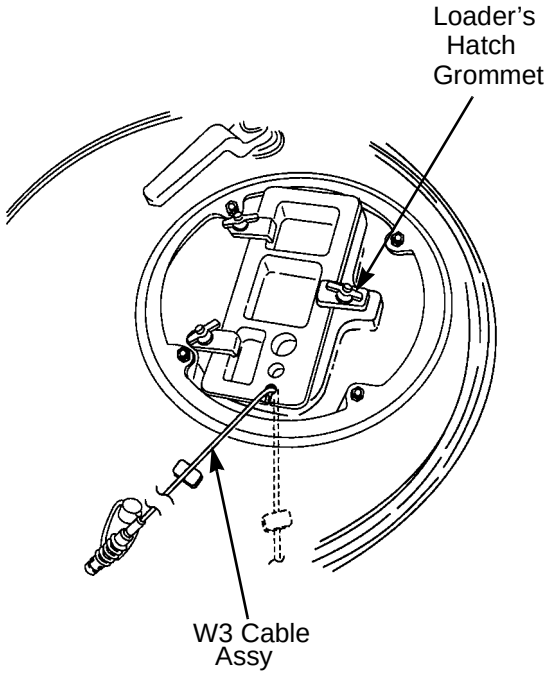
(5) Open loader's hatch to ensure that it can be operated without damaging W3 cable.

NOTE

DO NOT attach W3 cable to TBOS video mixer unit at this time.

(6) Secure W3 cable and W6 cable long lead in place along turret bustle rack railing and left sponson box rear railing with velcro straps.

2-4. INSTALLATION OF EXTERIOR CABLES (Con't).



2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES.

WARNING

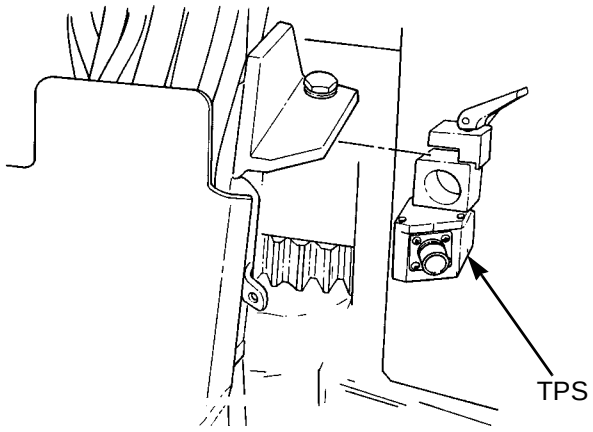
- **Vehicle master power switch, turret power switch, and TNB utility power switch must be in OFF position before installing interior components and cables.**
- **Gun must be locked to turret roof and turret traverse lock must be engaged before installing or removing components/cables under main gun.**
- **Ensure all cables and components are properly installed and secured. Improper installation can cause damage to equipment or injury to personnel.**

a. **<u>TPS Installation</u>.**

(1) Position TPS on turret floor support beam at right-rear of gunner's position. Ensure that TPS drive wheel meshes with turret ring gear.

(2) Lower locking handle to locked position.

2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).



b. **Vehicle Interface Assembly Installation.**

CAUTION

DO NOT use cables to lower vehicle interface assembly into turret. Failure to follow this caution may result in damage to cables or cable connectors.

NOTE

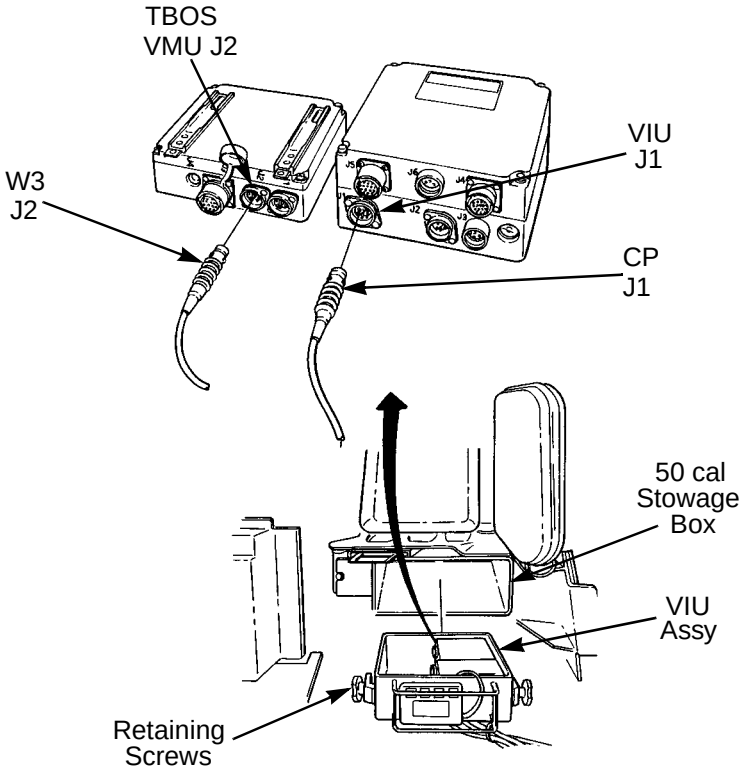
- **VIU, TBOS video mixer unit, and W4, W8, W9, and W10 cable assemblies are contained in the vehicle interface assembly.**
- **Before installing vehicle interface assembly, ensure that W4, W8, W9, and W10 cables are properly connected to TBOS video mixer unit and VIU.**

(1) Connect W3 connector J2 to TBOS video mixer unit connector J2.

(2) Connect control panel connector J1 to VIU connector J1.

(3) Loosen two retaining screws and lower vehicle interface assembly into .50 cal. ammunition storage box until bracket mounting flange is resting on wall of .50 cal. ammunition storage box. Tighten two retaining screws.

2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).



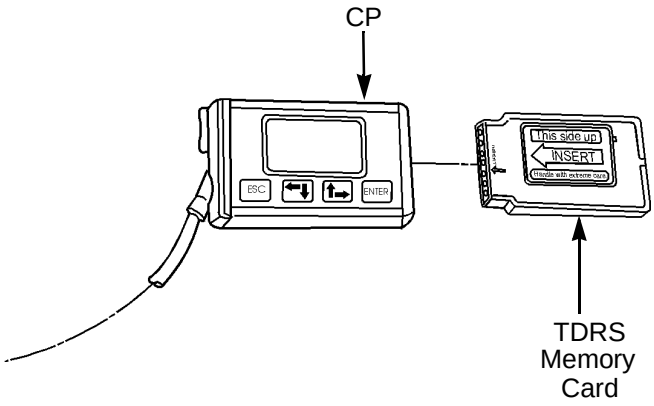
2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).

(4) Install TDRS memory card in control panel until flush with end of control panel.

CAUTION

Ensure control panel remains under vehicle interface assembly handle during training. DO NOT step on vehicle interface assembly handle when entering or exiting turret. Failure to follow this caution could result in damage to equipment.

(5) Place control panel under vehicle interface assembly handle.



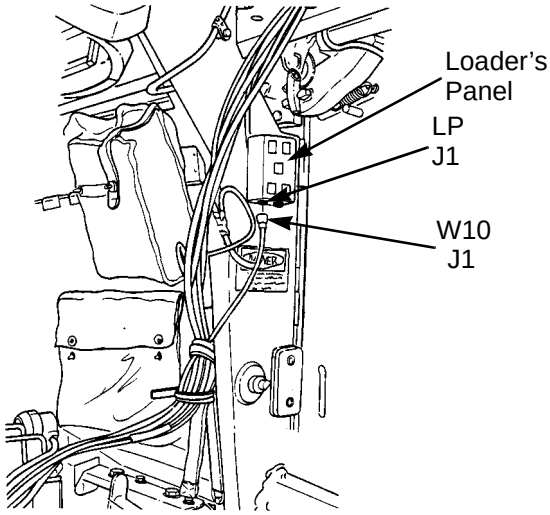
2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).

c. **Interior Cables Installation.**

(1) Route cable bundle containing W8, W9, and W10 cables from vehicle interface assembly up to turret roof support beam. Secure cable bundle to turret roof support with velcro strap.

(2) Install loader's panel on center support beam between bustle ammo storage doors and facing loader.

(3) Connect W10 connector J1 to loader's panel connector J1.



2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).

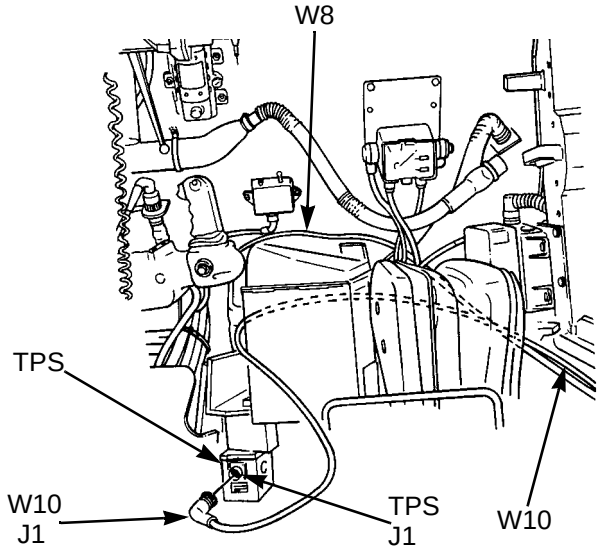
NOTE

Ensure that cables are secured to turret with velcro straps so as not to interfere with operation of ammo storage doors.

(4) Route W10 cable behind commander's position and along right turret wall to TPS.

(5) Connect W10 connector J1 to TPS connector J1. Secure cable to turret with velcro strap.

(6) Locate W8 cable and route behind commander's position and along turret wall over gunner's CCP.

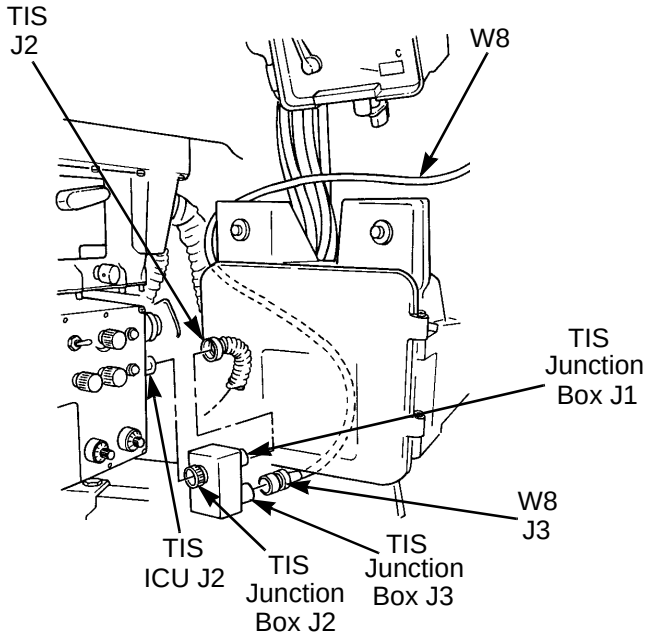


2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).

(7) Disconnect TIS connector J2 from TIS control panel connector J2 .

(8) Connect TIS connector J2 to TIS junction box connector J1.

(9) Connect W8 connector J3 to TIS junction box connector J3.



CAUTION

- **Use care when positioning TIS junction box to prevent damage to pins of TIS control panel connector.**
- **When connecting TIS junction box to TIS control panel, hand tighten connector. The use of tools will result in damage to TIS junction box.**

(10) Connect TIS junction box connector J2 to TIS control panel connector J2.

(11) Route cable bundle containing W9 and W10 cables from turret roof support over ammunition storage door at loader's position, and along turret wall between turret storage box and ammunition storage box.

NOTE

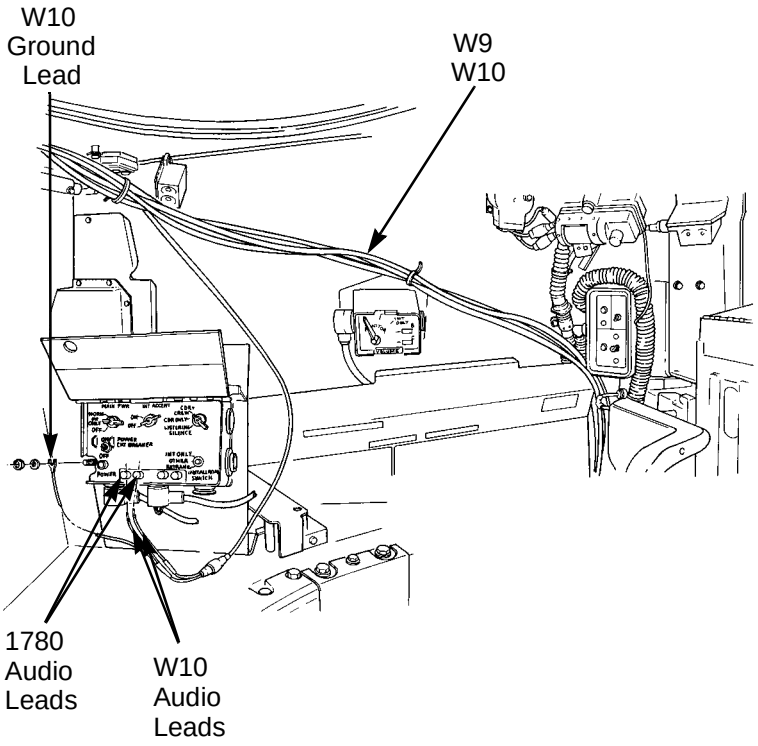
When using the AN/VIC-3(V), install training adapter to MCS amplifier terminals. Install W10 cable audio input and audio ground leads to corresponding connection on training adapter (see page 2-38).

(12) Locate audio input and ground cable leads of W10 cable. Lift AM1780/VRC cover and connect audio input and ground leads to amplifier terminals. Close cover.

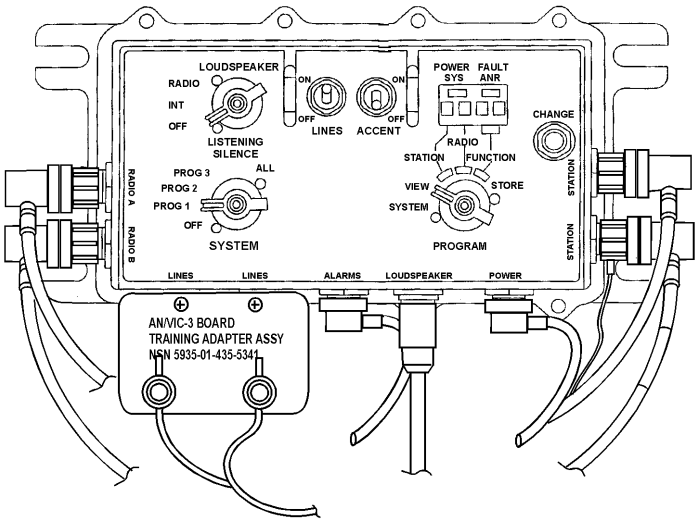
(13) Loosen AM1780/VRC lower left mounting nut and position ground lead under washer. Tighten nut.

(14) Route W9 cable to TNB, but DO NOT connect at this time.

2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).

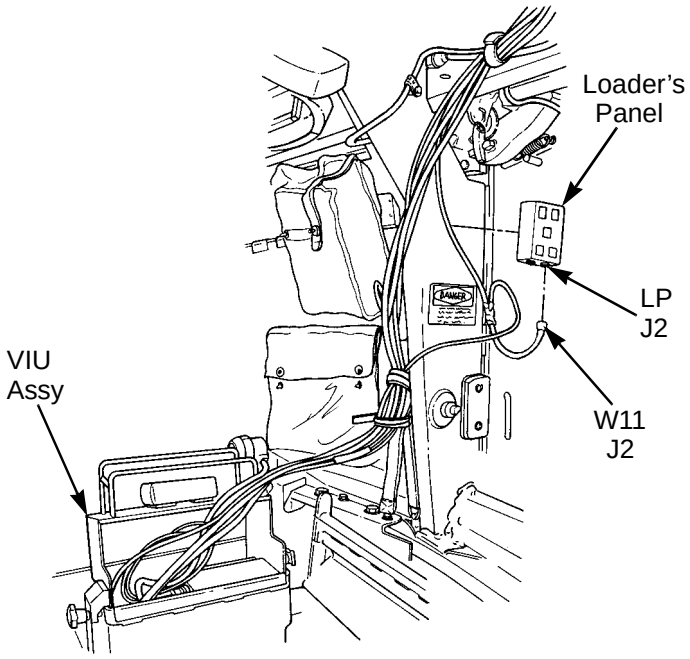


2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).



2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).

(15) Connect W11 connector J2 to loader's panel connector J2.



2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).

NOTE

Ensure cables are secured to turret with velcro straps so as not to interfere with operation of ammo storage doors.

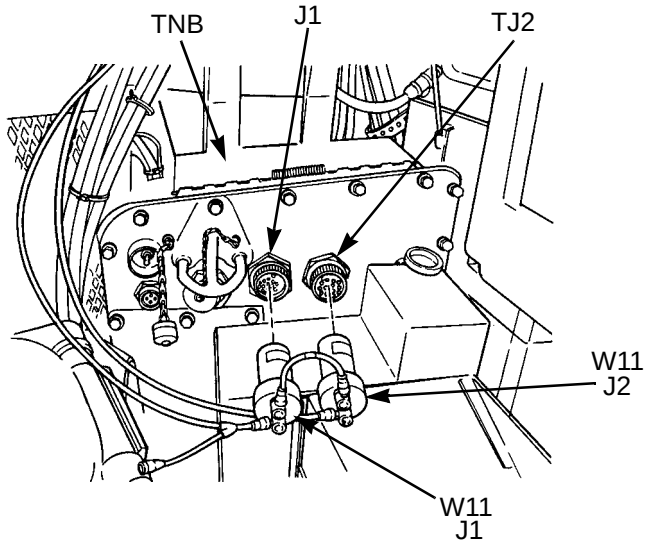
(16) Route W11 cable bundle to turret support beam, over ammunition storage door at loader's position, and along left turret wall to TNB.

(17) Remove two protective covers from TNB test connectors TEST1 and TEST2.

NOTE

Note position of wide alignment key on W11 cable node connectors to aid in installation.

(18) Connect W11 cable node connectors J1 and J2 to TNB test connectors TEST1 and TEST2.



2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).

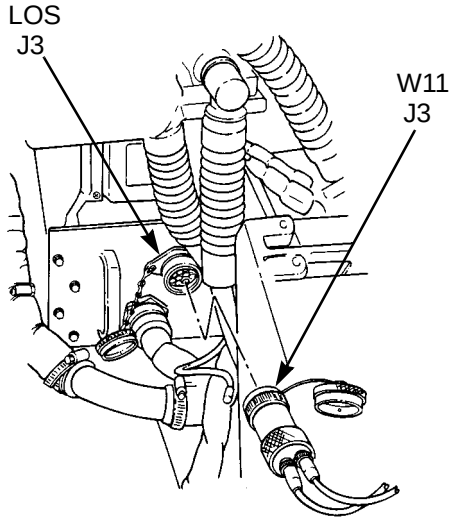
CAUTION

W11 cable must be routed so that it is protected from being stepped on or squeezed during elevation or depression of main gun.

(19) Route W11 cable assembly along floor on left side of coax ready ammo box to LOS and CEU units.

NOTE

(20) Remove protective cover from LOS unit test connector J3. Connect W11 cable node connector J3 to LOS unit test connector J3.



2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).

(21) Disconnect vehicle cable 1W202-9P1 from CEU connector J3.

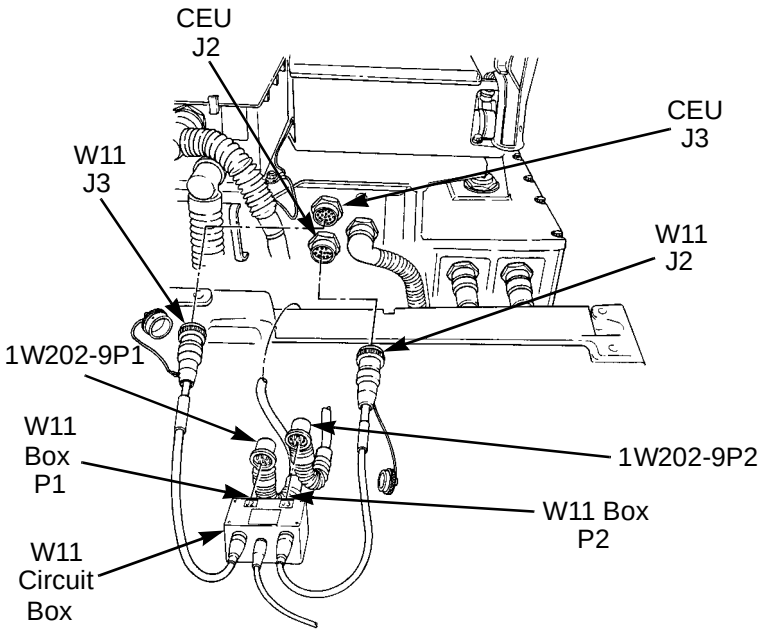
(22) Connect vehicle cable 1W202-9P1 to connector P1 of W11 cable circuit box.

(23) Disconnect vehicle cable 1W202-9P2 from CEU connector J2.

(24) Connect vehicle cable 1W202-9P2 to connector P2 of W11 cable circuit box.

(25) Connect W11 cable assembly connector J2 to CEU connector J2.

(26) Connect W11 cable assembly connector J3 to CEU connector J3.



WARNING

DO NOT connect Improved Tank Gunfire Simulator (Hoffman Device) unless vehicle master power switch is In OFF position and simulator safety switch in OFF position, with key removed. Failure to follow this warning may result in injury or death to personnel.

CAUTION

Do not connect cable W9 Hoffman Power to cable W11 Hoffman Trigger when Hoffman Device is not used. Failure to follow this caution could cause equipment damage.

NOTE

Perform steps 27 through 31 only if Hoffman Device is installed on tank.

(27) Connect W9 connector HOFFMAN GROUND to Hoffman Device cable connector HOFFMAN GROUND.

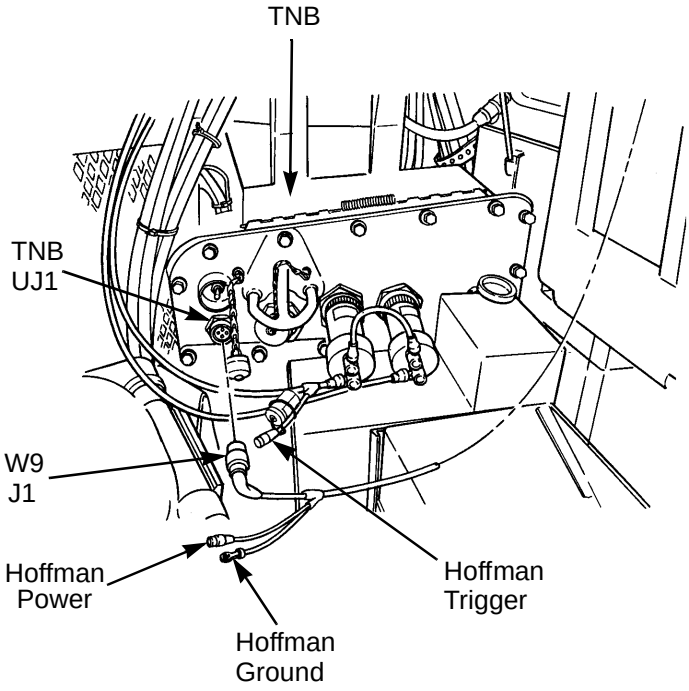
(28) Connect W9 connector HOFFMAN POWER to Hoffman Device cable connector HOFFMAN POWER.

(29) Connect W11 cable connector HOFFMAN TRIGGER to Hoffman Device cable connector HOFFMAN TRIGGER.

(30) Route W11 cable from TNB along left side of TNB to the floor.

(31) Remove protective cover from TNB connector UJ1. Connect W9 cable connector J1 to TNB connector UJ1.

2-5. INSTALLATION OF INTERIOR COMPONENTS AND CABLES (Con't).



2-6. ALIGNMENT PROCEDURES.

NOTE

- **Alignment MUST be performed in strict accordance with instructions provided to ensure proper training results.**
- **Ensure during alignment that only one RRU and no other reflective objects are visible.**

a. **Alignment Target Placement.**

(1) Position a target panel as close to 1200 meters away from the tank as possible. Target panel should be placed so that main gun is over the front of the tank when main gun is aligned with target panel.

(2) Mount an RRU (see TM 9-6920-703-10) on target panel.

b. **Vehicle Preparation and TWGSS Start-up.**

(1) Place vehicle master power switch in ON position.

(2) Place turret power switch in ON position .

(3) Set gun/turret drive switch in MANUAL position.

(4) Verify that fire control malfunction lamp on commander's control panel does NOT indicate a malfunction. If a malfunction is indicated, perform operator/crew troubleshooting.

(5) Place TNB utility power switch in ON position.

c. **System Alignment.**

WARNING

The commander must ensure that the loader and other personnel remain a safe distance away from the main gun when not actively participating in TWGSS alignment procedures. Failure to follow this warning may result in injury or death to personnel.

(1) Select AL and press ENTER.

NOTE

When AL is selected and ENTER is pressed to select an alignment submenu, the following pop-up screens appear. Ensure that the information on the pop-up screen matches vehicle setup. Press ENTER to continue after each setting.

(2) Place gun select switch in MAIN position.

(3) Set fire control mode switch to MANUAL.

(4) Place GPS magnification lever in 10X position.

(5) Press ENTER.

(6) Open CCP door and set CCP power switch to ON position.

NOTE

During TWGSS alignment, always enter 1200 m in FCS regardless of range to alignment RRU. Failure to follow this note will result in incorrect training results.

(7) Use keypad to enter 1200 m into fire control system (FCS).

(8) Select SABOT.

(9) Press ENTER on control panel to continue.

(10) Press and release gunner's control palm switch.

(11) Press ENTER on control panel.

(12) Press ESC.

d. **Cant Alignment.**

(1) Press CANT on CCP.

(2) Select AL and press ENTER.

(3) Select CA on control panel and press ENTER.

NOTE

Cant angle of TU is displayed on control panel.

(4) Have loader lower TU locking handle and slowly rotate TU until control panel displays same cant angle and direction as CCP. Values indicated on CCP and control panel should be within ±0.5° of each other.

CAUTION

Ensure that TU is properly LOCKED into mounting bracket by checking that TU locking handle is in raised position. Failure to perform this check may result in TU falling out of mounting bracket and becoming damaged.

(5) Have loader raise TU locking handle to locked position.

(6) Press ESC.

(7) Cancel CANT on CCP.

e. **Laser Alignment.**

(1) Select AL and press ENTER.

(2) Select LA and press ENTER.

(3) Press boresight on CCP.

(4) Press ENTER on control panel.

(5) Using gunner's manual controls while looking through GPS, lay GPS aiming point on center of retro reflector unit mounted on target panel.

(6) Select R and press ENTER.

NOTE

- **DO NOT adjust lay of main gun at any time when performing steps 7 and 8.**
- **Ensure that only one retro reflector unit is visible within field of view.**

(7) Select M and press ENTER.

(8) Press ENTER a minimum of three times.

NOTE

If SAVE is selected prior to three laser measurements, a pop-up screen appears.

(9) Select S and press ENTER.

NOTE

If ESC is pressed while a pop-up screen is displayed, measurement is not saved. A pop-up screen appears.

(10) Press ESC.

f. **TBOS GAS Alignment.**

(1) Select AL and press ENTER.

(2) Select a target with a dark background to allow for better observation of TBOS effects.

(3) Select GA and press ENTER. An aiming cross with an alignment dot appears in the GAS.

(4) Select R and press ENTER.

(5) Select AL and press ENTER. Only the aiming cross appears in the GAS.

NOTE

When alignment is selected, TBOS alignment steps are displayed on control panel.

(6) Rotate aiming cross until aligned with reticle, using up/down arrow buttons. Cross is properly positioned when it rests directly over the GAS boresight cross. Shorter vertical line in aiming cross MUST point downward.

(7) Press ENTER to save and continue alignment.

(8) Using up/down arrow buttons, adjust position of TBOS dot until dot is level with.

(9) Press ENTER to save and continue alignment.

(10) Using left/right arrow buttons, adjust position of TBOS dot until dot is level with reticle boremark.

(11) Press ENTER to save.

NOTE

After ENTER is pressed, the TBOS alignment reticle is displayed. If not properly aligned with sight reticle, repeat steps 4 through 11.

(12) Press ESC.

g. **TBOS GPS Day Alignment.**

(1) Select AL and press ENTER.

(2) Select a target with a dark background to allow for better observation of TBOS effects.

(3) Select GD and press ENTER.

NOTE

If TIS thermal mode switch is set to incorrect position during alignment, press ESC to leave alignment menu. Select proper setting and restart alignment.

(4) Set GPS FLT/CLEAR/SHTR switch to CLEAR position and TIS switch to STANDBY. Press ENTER on control panel. Only the alignment dot appears in the GPS.

(5) Select R and press ENTER.

(6) Select AL and press ENTER.

NOTE

When alignment is selected, TBOS alignment steps are displayed on control panel.

(7) Using up/down arrow buttons, adjust position of TBOS dot until dot is level with reticle aiming point.

(8) Press ENTER to save and continue alignment.

(9) Using left/right arrow button, adjust position of TBOS dot onto reticle aiming point.

(10) Press ENTER to save.

NOTE

After ENTER is pressed, the TBOS alignment dot is displayed. If not properly aligned, repeat steps 5 through 10.

(11) Press ESC.

h. **TBOS GPS Thermal Alignment.**

(1) Select AL and press ENTER.

(2) Select GT and press ENTER.

(3) Set GPS FLT/CLEAR/SHTR switch to SHUTTER position. Press ENTER on control panel.

(4) Move TIS thermal mode switch from STBY position to ON position. Press ENTER on control panel. Only the alignment dot appears in the GPS.

(5) Select R and press ENTER.

(6) Select AL and press ENTER.

NOTE

When alignment is selected, TBOS alignment steps are displayed on the control panel.

(7) Using up/down arrow buttons, adjust position of TBOS dot until dot is level with reticle aiming point.

(8) Press ENTER to save and continue alignment.

(9) Using left/right arrow buttons, adjust position of TBOS dot onto reticle aiming point.

(10) Press ENTER to save.

NOTE

After ENTER is pressed, the align TBOS screen is displayed. If further adjustment is required, repeat steps 6 through 11.

(11) Press ESC.

i. **TPS Alignment.**

(1) Select AL and press ENTER.

(2) Position main gun over driver's hatch and centered between headlights.

(3) Select TP and press ENTER.

(4) Press ENTER to save.

(5) Press ESC.

(6) Press ENTER on CCP to leave boresight mode.

(7) Close CCP door.

2-7. SETUP PROCEDURES.

a. **Backlight.**

(1) Select SU and press ENTER.

(2) Select BL and press left arrow button to turn backlight ON or right arrow button to turn backlight OFF. Press ENTER.

(3) Press ENTER.

b. **Contrast.**

(1) Select SU and press ENTER.

2-7. SETUP PROCEDURES (Con't).

(2) Select CO and use left/right arrow buttons to change contrast. Press ENTER.

(3) Press ESC.

Section II. OPERATION OF TWGSS

2-8. GENERAL.

NOTE

For detailed information on scaled gunnery or tracking training see TM 9-6920-709-12&P-1-1.

a. This section describes operation of the Tank Weapon Gunnery Simulation System (TWGSS). The crew operates the tank weapons systems in their normal mode of operation and crew input to TWGSS is not required except for the loader. The loader simulates main gun loading by pressing a pushbutton on the loader's panel which selects the type of ammunition as directed by tank commander.

b. The TWGSS training exercise is set up by the instructor using the Training Data Retrieval System (TDRS) computer unit. The instructor sets the ammunition allowance and obscuration burn time. Refer to TM 9-6920-711-12&P-1.

c. Target engagement feedback is provided by the TWGSS in the form of audio tones and visual effects. When simulating firing on a target vehicle, the appropriate sound signature will accompany the loading and firing of the weapon. In the sight, the gunner can see the visual effects of firing obscuration, tracers, burst on target, and burst on ground. Listed below are the audio and visual effects provided during operation of the TWGSS.

(1) Audio tones and control panel messages indicate to target vehicles that they are under fire or destroyed.

(2) Strobe lights indicate to firing vehicle that the target is hit or destroyed.

2-9. CREW OPERATIONS.

NOTE

- **During an upload sequence, TWGSS transfers a full ready rack (turret) or remaining ammunition in semi-ready rack (hull).**
- **The remaining time of upload appears on control panel display screen.**
- **When ammunition has been uploaded, COMPLETED will appear on control panel display screen.**
- **Upload time is programmed on TDRS memory card by training controller.**
- **If ESC is pressed during an upload sequence, process is stopped and ammunition is not transferred.**

a. **Ammunition.** The crew can monitor remaining ammunition during an exercise using the control panel.

(1) Select SI and press ENTER.

(2) Select RM and press ENTER.

(3) To monitor main gun ammunition, select MW.

(4) To upload main gun ammunition, press ENTER.

(5) Select main gun ammunition to be uploaded using up/down arrow buttons.

(6) Press ENTER to start upload.

(7) To monitor coax ammunition, select CO.

(8) Press ENTER to start upload.

b. **Laser Rangefinder (LRF).** The crew can select either TWGSS rangefinder or tank rangefinder.

2-9. CREW OPERATIONS (Con't).

WARNING

Tank MUST be equipped with LRF eye-safe laser filter (ELF) during ALL training exercises. Failure to follow this warning may result in injury or blindness to personnel.

NOTE

- **When conducting 1/10th or 1/2 scale training, TWGSS LRF must be selected.**
- **If vehicle master power switch has been set to OFF position and then returned to ON position, TWGSS LRF will automatically be selected.**

(1) Select LF and press ENTER.

(2) Using up/down arrows buttons, select LRF to be used and press ENTER.

2-10. RESULTS.

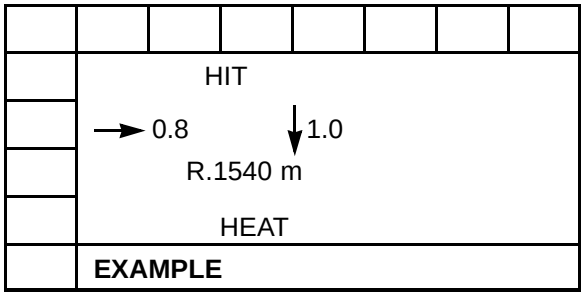
a. **General.** Results of the training exercise can be displayed numerically or graphically, or the result presentation can be turned off.

b. **Numerical Presentation.**

(1) Numerical presentation allows for immediate feedback and result presentation of hit coordinates and type of ammunition.

(2) Results are presented in a pop-up screen on the control panel.

(3) A pop-up screen appears until a new result is displayed or a control panel button is pressed.



c. **Graphics Display (GD).**

(1) Graphic presentation allows for immediate feedback and is used for panel gunnery training exercises where display of the hit in relation to the target outline is preferred over actual hit coordinates.

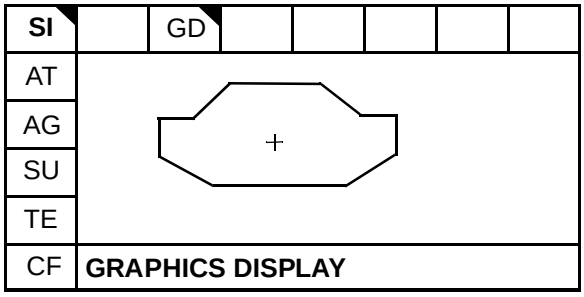
NOTE

This screen identifies the target silhouette and hit position (x) in relation to target center of mass (+).

(2) Select SI and press ENTER.

2-10. RESULTS (Con't).

(3) To view results graphically, select GD and press ENTER. Graphics display shows the target template of ammo fired.



(4) Press ESC to exit graphics display.

d. **Result Presentation Off.** For force-on-force exercises, the instructor can program the TDRS memory card to store the training results without displaying them on the control panel.

2-11. DESCRIPTION OF HIT RESULT.

a. TWGSS provides results for firing vehicles and target vehicles.

b. A fire result provides information in four areas:

(1) Engagement evaluation.

(a) **HIT.** A HIT presentation indicates that the simulated round has hit the target. TWGSS assumes the target to be either a T80 Front (NATO standard size) for main gun rounds or a kneeling soldier for coax rounds. If the control panel indicates HIT, MILES codes are transmitted to enable the laser target interface device (LTID) to indicate.

2-11. DESCRIPTION OF HIT RESULT (Con't).

(b) **GROUND HIT.** A GROUND HIT presentation indicates that the ammunition has fallen short or long. The range for the actual ground impact is presented.

(c) **MAX RANGE.** If the control panel indicates MAX RANGE, the ammunition has passed above the target and reached the maximum simulated range of the ammunition.

(2) Elevation and azimuth impact point on target in relation to center of mass.

(3) Actual range, in meters, to target.

(4) Type of ammunition fired.

2-12. TARGET RESULT PRESENTATION.

A target result provides information in three areas:

a. Effect of incoming round on vehicle (target system evaluation).

(1) **NEAR MISS.** A projectile has passed close to the vehicle. The crew can continue to fight.

(2) **HIT.** The vehicle is hit, but not damaged. The crew can continue to fight.

(3) **MOBILITY KILL.** The vehicle is damaged and immobilized by a hit. If the control panel indicates MOBILITY KILL, the crew must stop tank within 30 seconds or the vehicle will be permanently killed. When a vehicle has suffered a mobility kill, the crew can continue to engage targets with their weapons from a standstill position.

(4) **WEAPON KILL.** The vehicle is hit and the weapon system is damaged. The crew can move the vehicle, but cannot fire any weapons.

2-12. TARGET RESULT PRESENTATION (Con't).

(5) **KILL.** The vehicle is hit and has sustained a catastrophic kill. The crew cannot move the vehicle or fire any weapons.

b. Aspect angle of incoming round. Aspect angle is divided into 12 sectors according to the clock.

c. Elevation and azimuth impact point on vehicle in relation to center of mass.

2-13. AUDIO INDICATIONS.

a. **General.** The system uses sound to indicate to the crew that different events have taken place. The audio indications can be divided into firing system, target system, and system error audio indications.

b. **Audio Indications of Firing System.** During loading and firing of ammunition, the following audio indications are heard through the tank intercom:

(1) Opening/closing of ammunition door. This occurs when the loader uses the loader's panel to load/unload ammunition.

(2) Closing of breech block. This indicates that the round is chambered and ready to be fired.

NOTE

If the gun is left loaded and armed for more than 30 minutes, TWGSS will go into a power down mode. Loader must SAFE then ARM the gun prior to firing.

(3) Main gun fire and ammunition case base ejection from breech. This indicates a successful firing of a round.

(4) Coax fire.

c. **Audio Indications of Target System.** When a TWGSS system is fired upon from other simulator equipped vehicles, the tank intercom indicates that the vehicle is being fired upon.

NOTE

On newer systems, voice messages will follow audio "beeps".

(1) **NEAR MISS.** If the vehicle had a near miss, two "beeps" or two "beeps" followed by "Near Miss, Direct Fire" are transmitted on the vehicle intercom.

(2) **HIT (NO KILL).** If the vehicle is hit, but not killed, 4-6 "beeps" or 4-6 "beeps" followed by "Hit, Direct Fire" are transmitted on the vehicle intercom.

NOTE

If panel gunnery training is used, the target system is auto-activated after 5 seconds. The audio indication stops and the system is operational. The kill is stored on the TDRS memory card together with auto-activation for After Action Review (AAR).

(3) **HIT (MOBILITY KILL).** If the vehicle is hit and the target computer has determined that a mobility kill has occurred, 4-6 "beeps" or 4-6 "beeps" followed by "Hit Mobility" are transmitted on the vehicle intercom. In addition, the control panel informs commander of action to take.

(4) **HIT (WEAPON KILL).** If the vehicle is hit and the target computer has determined that a weapon kill has occurred, 4-6 "beeps" or 4-6 "beeps" followed by "Hit Firepower" are transmitted on the vehicle intercom. In addition, the control panel informs commander of action to take.

(5) **KILL.** A continuous tone for 30 seconds or "Vehicle Kill" followed by a continuous tone for 30 seconds is transmitted on the vehicle intercom.

d. **System Errors.** Audio indication is also provided for system errors.

2-14. VISUAL INDICATIONS OF SYSTEM.

The target system indicates the effect of an engagement with the RDU strobe lights. The following visual indications are given by the target system:

a. **NEAR MISS.** If a target receives a near miss, RDU strobe light blinks 2 times.

NOTE

Mobility kill and weapon kill are also indicated with 4-6 indicators.

b. **HIT.** If the target is hit, but not killed, RDU strobe light blinks 4-6 times.

NOTE

If panel gunnery training is used, the target system is auto-activated after 5 seconds. The indication stops and the system is operational.

c. **KILL.** If the target is hit and killed by a round or by a CGUN, RDU strobe light blinks continuously until the system is reset by the CGUN.

d. **Weapon Firing Sequence.** The front RDUs will flash when the coax weapon is being fired.

APPENDIX A
TROUBLESHOOTING CHECKLIST

If you have difficulty operating TWGSS, take the time to perform the following checks before you decide that there is something wrong with your system.

- Make sure that you have the vehicle master power, turret power, and TNB utility power ON.
- Make sure that the gun/turret drive switch is in MANUAL position.
- Check that main gun safe/armed handle is in ARMED position.
- Verify that the TDRS memory card is properly installed in control panel.
- Verify that the tank fire control malfunction lamp does NOT indicate a malfunction. If a malfunction is indicated, turn all power OFF.
- Verify that TWGSS malfunction indicator lights located on the vehicle interface unit, TBOS driver unit, and target computer unit are blinking. If malfunction light is on but NOT blinking or is OFF, perform troubleshooting.
- Check all cable connections to ensure that they are tight.
- Check BIT error list by selecting TE on the control panel and pressing ENTER. Correct errors or notify a trained TWGSS troubleshooter.
- Manually run BIT by selecting BT on the control panel and pressing ENTER. Correct errors or notify a trained TWGSS troubleshooter.
- Refer to TM 9-6920-709-12&P-1-1 for detailed trouble-shooting information.

APPENDIX B
LIST OF ABBREVIATIONS

AAR . . . . . After Action Review
BII . . . . . Basic Issue Items
BIT. . . . . Built-in Test
CCP. . . . . Computer Control Panel
CEU. . . . . Computer Electronics Unit
CGUN . . . . . Control Gun
CP . . . . . Control Panel
ELF . . . . . Eye-safe Laser Filter
FCS . . . . . Firing Control System
GAS. . . . . Gunner's Auxiliary Sight
GPS. . . . . Gunner's Primary Sight
HDDU . . . . . Hull Defilade Detector Unit
ITGS . . . . . Improved Tank Gunfire Simulator
LOS . . . . . Line-of-Sight
LP . . . . . Loader’s Panel
LRF . . . . . Laser Rangefinder
LTID. . . . . Laser Target Interface Device
MILES . . . . . Multiple Integrated Laser Engagement System
PGS. . . . . Precision Gunnery System
PMCS . . . . . Preventive Maintenance Checks and Services
RDU . . . . . Retro Detector Unit
RRU . . . . . Retro Reflector Unit
RSI . . . . . Remote System Interface
TBOS . . . . . Tracer, Burst, Obscuration Simulator
TCU. . . . . Target Computer Unit
TDRS . . . . . Training Data Retrieval System
TIS. . . . . Thermal Imaging System
TNB . . . . . Turret Networks Box
TPS . . . . . Turret Position Sensor
TSV . . . . . Thru-Sight Video
TU . . . . . Transceiver Unit

LIST OF ABBREVIATIONS (Con't)

TWGSS . . . . . Tank Weapon Gunnery Simulation System
VIU . . . . . Vehicle Interface Unit
VMU . . . . . Video Mixer Unit